Thesis/
Reports
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ALTERNATIVE ACTIONS ANALYSIS EVALUATION DECISION PROCESS

Region 3

USDA Forest Service

By

Clyde G. Weller

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ROCKY MOUNTAIN STATION

TRANSPORTATION ENGINEERING HANDBOOK

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TRANSPORTATION ENGINEERING HANDBOOK

CHAPTER 16 - SUPPORT ACTIVITIES

16.4 - TRANSPORTATION ECONOMICS AND COMPARISON ANALYSIS

16.41 - Objectives. The purpose of economic and effect comparison analysis is to provide the land manager and the public with the comparisons of feasible alternative solutions. Decisionmaking can be improved by arraying and evaluating the facts about various investment alternatives. All capital investments can be ordered by engineering economics, relative social and environmental impacts, financial impacts, and institutional impacts. The purpose of this section is to demonstrate how to perform economic, social, environmental, institutional, and financial analyses and evaluations, how to display these comparative analyses and evaluations, and why it is beneficial. This documentation process also fulfills legal requirements for Forest Service decisions that affect the environment. Additional comparison evaluation tools have been presented in the first portion of Section 16.

16.42 - Definitions.

1. Engineering Economics: The term "engineering economics" is more aptly termed "capital economics" in that it deals with the

investment of capital funds for beneficial returns. Capital economics is directly related to the capital budget which establishes which investments will be funded. Capital budget differs from operating budget in that it goes beyond a current program concerned with existing facilities and uses capital investments to improve outputs or reduce operating costs. Capital economics is the evaluation of the return from a capital investment over a defined period of time.

2. Economic Analysis: The choice between alternatives is common to engineering and all business activities. All alternatives may be economical (will create more benefits than costs), but one alternative may be more economical.

Several economic indicators exist which analyze cash flows that enable ranking of alternatives. The economic indicators are discount rate, internal rate of return (IRR), present worth, and equivalent annual costs. Analysis of any one of these indicators is not always sufficient to rate alternatives economically.

3. Cash Flow: Cash flow for any one project, capital investment, or "do nothing" alternative is the chronological listing of all dollar benefits and costs for the life of the project or a group of projects.

4. Financial Analysis: Financial analysis differs from economic analysis in that it evaluates who pays how much and from what account.

It determines if the capital funding is available, with all other projects considered, to enter into the project being considered. Cash flow ties economic and financial analyses together.

5. Discount Rates: This is the annual percentage interest rate that must be paid or received for the use of money. A 10 percent interest rate means it will cost $1,000 plus 10 percent of $1,000, or $1,100, at the end of year one for the use of the $1,000 starting now.

6. Present Value: This is the current value of a future cash flow of benefits and costs at a specified discount rate. The present value of $1,100 at the end of year one at 10 percent interest is $1,000.

7. Benefits and Costs: Benefits are positive values of socio-economic concerns derived from capital investments or operations which are negative values or costs. Benefits and costs can be measured in either quantitative or qualitative terms.

8. Quantitative Variables: All benefits and costs that can be market dollar valued are quantitative; e.g., haul costs, maintenance costs, timber harvest costs, timber values, cattle values, range improvement costs, fire protection costs, recreation values, etc. Engineering economics can be applied to these variables.

9. Qualitative Variables: All benefit and cost variables which cannot be market valued that deal with emotions, opinions, biases, psychology, environmental concerns, etc., are considered qualitative. These variables cannot be economically evaluated but can be ordinally ranked as good, better, best, or ++ and --.

10. Foregone Benefits and Costs: These are the benefits and costs which will not be realized or incurred due to the selection of one alternative solution over another.

11. Internal Rate of Return - IRR: The internal rate of return is defined as the interest rate at which the present worth of the benefits is equal to the present worth of the costs or the interest rate where the net present worth is equal to 0. In formula form PWB = PWC, NPW = 0 = PWB - PWC.

12. Benefit/Cost Ratio - B/C: The benefit-cost ratio is defined as the ratio of the present worth of the benefits to the present worth of the costs. Therefore, there are as many benefit-cost ratios as interest rates used.

13. Analysis: Analysis is the process of examining the component parts of a complex.

14. Evaluation: Evaluation is the process of determining the value or significance of the component parts and the whole complex.

15. Decisionmaking: Decisionmaking is the process of determining a selected action after consideration.

16. Alternatives: Alternatives are situations offering a choice between two or more mutually exclusive courses of action.

17. Project Life: This is the time in years (normally) of the economic life of a project. Twenty years is normally used for engineering road projects. It could be 10 years or less for equipment that depreciates rapidly.

16.43 - Alternative Analysis

Trade off analysis of each alternative action must be done at this stage. Dollar value all variables possible. Quantify all variables possible that cannot be dollar valued and subjectively value all illquantifiables (see Exhibit 16.43--7).

1. Engineering Economics Impact Analyses.

a. Cash Flow. The first item that must be established for economic analysis purposes is the cash flow. This chronological listing of dollar benefits and costs may take time, as all resource values must be considered besides transportation maintenance, operations, and construction costs. An example cash flow is illustrated in Exhibit 16.43--1, for two projects. Costs usually are considered to occur at the beginning of years and benefits to

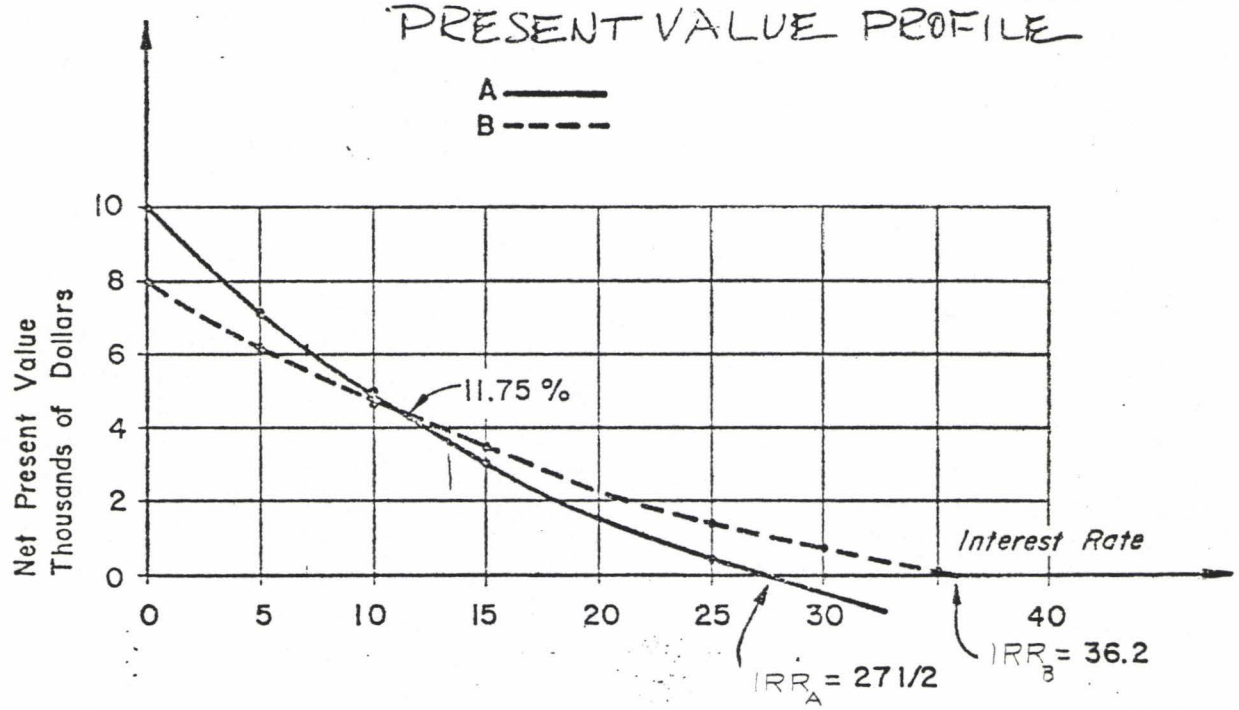
EXHIBIT 16.43-1

FIGURE I. ECONOMIC INDICATORS

CASH FLOW

PROJECT	A		B	
CASH FLOW	BENEFITS	COSTS	BENEFITS	COSTS
INITIAL COST:		$ 10,000		$ 10,000
BENEFITS:				
YEAR 1	$ 2,000		$ 7,000	
YEAR 2	4,000		5,000	
YEAR 3	6,000		4,000	
YEAR 4	8,000		2,000	

PRESENT VALUE PROFILE



B/C Ratios						
A	2.0	1.7	1.51	1.3	1.01	$\frac{B}{C}$ @ IRR = 1.0
B	1.8	1.6	1.49	1.4	1.17	

accrue at the end of years. Cash flows can be lumped into annual benefits and costs or can be divided into functional costs and benefits accruing to a project.

b. Present Value. Several discount rates should be used to calculate the present value of a cash flow. Ten percent is the Office of Management and Budget rate which must be used to evaluate capital projects approved by that agency. Several rates should be evaluated to show the comparative present worths of projects at various discount rates. The calculation is as follows for Project A of Exhibt 16.43--1, at 10 percent discount rate.[1]

Net Present Value or Net Present Worth = Present Worth Benefits - Present Worth Costs, or NPW = PWB - PWC where PWB = Single payment present worth factor or series payment present worth factor for the given interest rate for the year or number of years in which the benefits will occur times benefit value. Shown in formula form as (pwf' - 10% - 2 yr.) benefit.

PWB_A at 10% = (pwf' for 10% at 1 yr)2000 + (pwf' for 10% at 2 yr)4000
+ (pwf' for 10% at 3 yr)6000 + (pwf' for 10% at 4 yr)8000
= 0.9091(2000) + (.8264)4000 + (0.7513)6000 + (.6830)8000
= 15,095.60

---

[1] Grant and Ireson, Principles of Engineering Economics, (Ronald Press Co., New York, Fourth through Sixth Editions).

PWC_A at 10% = (pwf' for 10% at 0 yr)$10,000 = 1($10,000)

NPW = PWB - PWC = $15,095.60 - $10,000 = $5,095.60

Net Present Values for several interest rates can be calculated and plotted for each project. This plot is called the PRESENT VALUE PROFILE. See Exhibit 16.43--1 for the present value profile point for Project A at 10 percent and Net Present Value of $5,095.60.

c. Internal Rate of Return - IRR. The calculation of the IRR is accomplished by trial and error solution or can be calculated graphically as shown on the PRESENT VALUE PROFILE plot in Exhibit 16.43--1. The calculations for IRR of Project A are as follows:

PVB = PVC

try 15% as at 10% NPW = $5,096:

(pwf' for 15% at 1)2000 + (pwf' for 15% at 2)4000 + (pwf' for 15% at 3)6000 + (pwf' - 15% - 4)8000 - (pwf' - 15% - 0)10,000 = 0

(.8696)2000 + (.7561)4000 + (.6575)6000 + (.5718)8000 - 10,000 = 0

13,283 - 10,000 $\neq$ 0 and Benefits > Cost

try 20%:

(.8333)2000 + (.6944)(4000) + (.5787)(6000) + .4823(8000) - 10,000 = 0

11,774.80 - 10,000 $\neq$ 0 and Benefits $>$ Costs

try 25%:

.8000(2000) + .6400(4000) + (.5120)6000 + (.4096)8000 - 10,000 = 0

+ 508.8 = 10,508.80 - 10,000 $\neq$ 0 and Benefits $>$ Costs

try 30%:

.7692(2000) + (.5917)(4000) + (.4552)6000 + (.3501)8000 - 10,000 = 0

9437.20 - 10,000 = -$562.80 and Benefits $<$ Costs

Rigorous calculations give IRR = 27½%

The plot is close enough to a straight line that a straight line interpolation achieves adequate results.

$$\frac{+\ 508.8 - (-)\ 562.80}{5\%} = \frac{508.8}{X}$$

X = 2.37% IRR = 25 + 2.37 = 27.37 $\approx$ 27.5%

d. Benefit Cost Ratio. The benefit-cost ratio, B/C, of Project A at 10 percent interest is calculated as follows:

PWB_A at 10% = $15,095.60

PWC_A at 10% = 10,000.00

B/C_A at 10% = $\frac{15.095.60}{10,000.00}$ = 1.51

The B/C ratios for projects A and B are listed below the PRESENT VALUE PROFILE plot on Exhibit 16.43--1.

e. Marginal Economics. Marginal analysis is the process of determining what the additional (marginal) benefits or costs are over and above those associated with the existing situation. An example would be a proposal to reconstruct an existing road to a higher standard. It also is used in comparing nonexisting projects where the "do nothing" (without project) alternative is the base for comparison. Net present worth, internal rate of return, and benefit-cost ratios can also be applied to marginal economic analysis.

The "without project" discounted benefits and costs are subtracted from the "with project" discounted benefits and costs to produce (1) marginal discounted benefits and costs, (2) marginal net present worth, and (3) factors for determining marginal benefit/cost ratio for the proposed project. See Exhibit 16.43--2. Exhibit 16.43--3 is the tabulated calculations, and Exhibit 16.43--4 is a plot of the net present worths with and without the

project. The difference between the net present worth curves is the marginal net present worth curve.

f. Presentation of Project Economic Indicators. All three economic indicators (internal rate of return, net present worth, and benefit-cost ratios) plus marginal net present worth and marginal benefit-cost ratios should be displayed for the economic comparison for all alternatives for various discount rates. The discount rates which must be used are 10 percent and at least one discount rate above and below 10 percent. Five to 7 percent and 13 to 15 percent and the internal rate of return are normally sufficient for illustrating variances. At least the benefit-cost ratio at 10 percent must be shown. The B/C ratio at the discount rate equivalent to the IRR is always equal to 1.0. The ideal presentation is exemplified by Exhibit 16.43--2, Exhibit 16.43--3, and Exhibit 16.43--4.

EXHIBIT 16.43--2

Cash Flows

Year	Without Project		With Project	
	Benefits	Costs	Benefits	Cost
0				10,000
1	3000	2000	7000	
2	3000	2000	5000	
3	3000	2000	4000	
4	3000	2000	2000	

*For a series of equal payments, present worth can be calculated by using the series present worth factor, pwf:

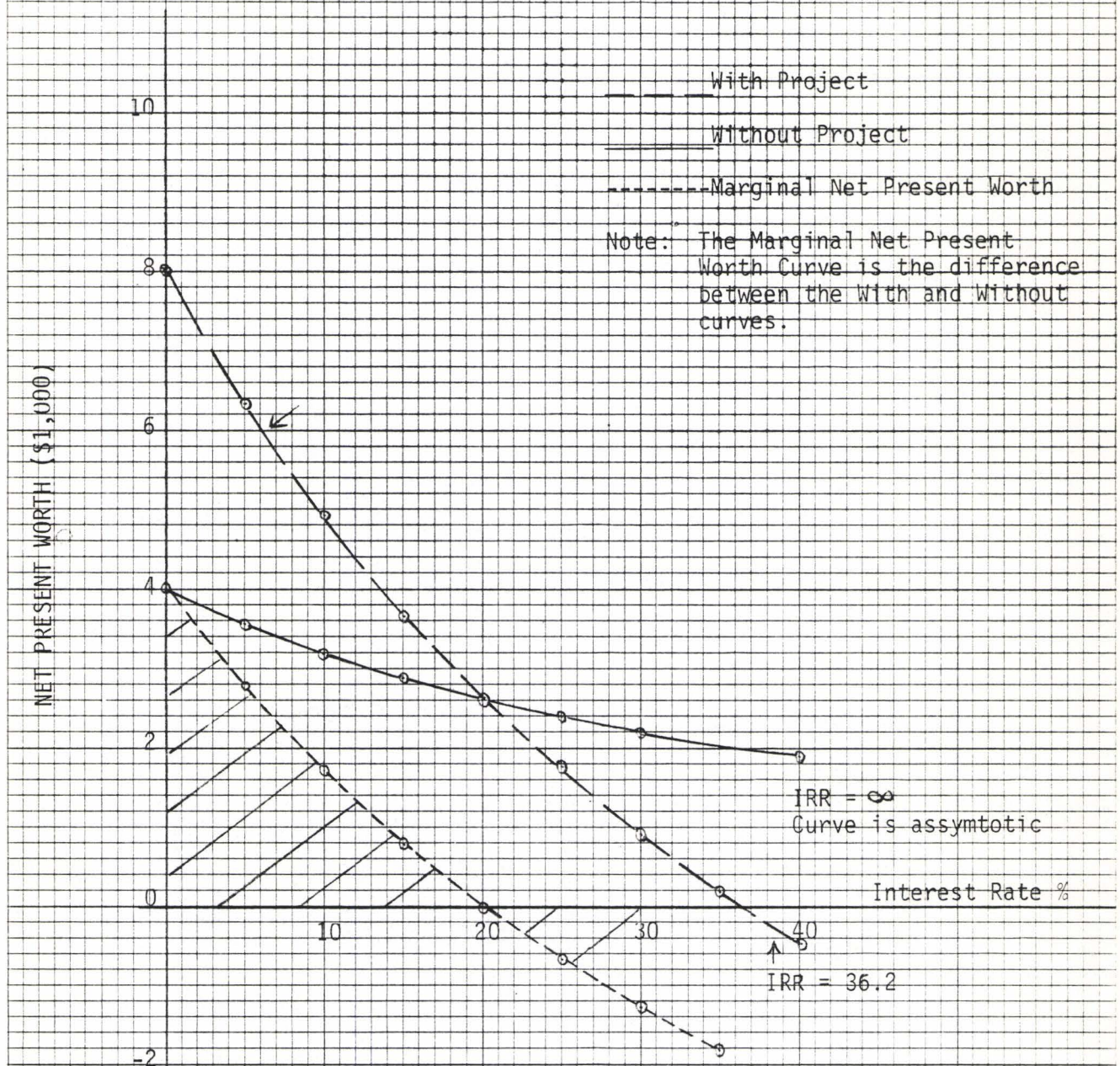
PWBw/o at 10% = \$3000 (pwf - 10% - 4 yrs)
= 3000(3.170) = 9510.0
or = 3000 (pwf' - 10% - 1) +
3000 (pwf' - 10% - 2) +
3000 (pwf' - 10% - 3) +
3000 (pwf' - 10% - 4)
= 3000 (0.9091 + 0.8264 + 0.7513 + 0.6830)
= 9510.0
PWCw at 10% = 2000(3.170) = \$6340

EXHIBIT 16.43--3

MARGINAL ANALYSIS
PRESENT WORTH

Interest Rate	With Project A Benefits	With Project B Costs	Without Project C Benefits	Without Project D Costs	E Benefits With Minus Benefits Without A-C	F Costs With Minus Costs Without B-D	Marginal Net Present Worth E-F	Marginal B/C Ratio E/F
0	18,000	10,000	12,000	8000	6000	2000	4000	3.00
5	16,302.4	10,000	10,638	7092	5664.4	2908	2756.4	1.95
10	14,866.9	10,000	9,510	6340	5356.9	3660	1696.9	1.46
15	13,641.3	10,000	8,565	5710	5076.3	4290	786.3	1.18
20	12,584.5	10,000	7,767	5178	4817.5	4822	(4.5)	1.00
25	11,667.2	10,000	7,086	4724	4581.2	5276	(694.8)	0.87
30	10,863.9	10,000	6,498	4332	4365.9	5668	(1302.1)	0.77
35	10,156.2	10,000	5,991	3994	4165.2	6006	(1840.8)	0.69
40	9,529.3	10,000	5,547	3698	3982.3	6302	(2319.7)	0.63

EXHIBIT 16.43--4
(MARGINAL (INCREMENTAL) ANALYSIS
PRESENTATION



At less than 20% interest rate the With Project alternative is most economical. The Without Project is always economical but not as much as the With Project alternative below 20% interest rate.

FP1 MI 10 X 10 TO 1 INCH
10TH LINE HEAVY

g. Foregone Benefits and Costs. Foregone benefits and costs must be evaluated. The economic, social, institutional, environmental, and financial analyses for foregone benefits and costs are no different from the previously described analyses. It can be achieved by marginal economic analysis with and without project. The "with project" and "without project" could be included as alternative solutions. Any variance in alternatives from the existing situation can be evaluated by the addition of the cost or benefit and evaluating the effects of that benefit or cost. This is also applicable to the following sections on social, institutional, environmental, and financial analyses. If a road is moved to protect a fishery, what are the marginal quantitative and qualitative benefits and costs?

h. Computer Economic Analysis. Several programs are operational at the Fort Collins Computer Center. Two names of these economic programs are RTECON and INVEST 3. RTECON was written explicitly for analyzing road and trail economics or other capital investments. All of the cited economic indicators are calculated and displayed for the proposed alternative versus the existing situation alternative. Exhibits 16.43--5 and 16.43--6, illustrate the output of the RTECON program. Forests are urged to use this program. Documentation of these economic analysis programs is available from Region 3. INVEST 3 is a Region 5 designed program which analyzes cash flows similarly to RTECON.

* JOB SEQUENCE NO. 3 28 SEP 7

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SUMMARY OF PROJECT RELATED ECONOMICS AND RESOURCE USE

CORONADO N.F. SWIFT TRAIL(STAB.-CON.) ROAD NO.FH-34

****

PROJECT RELATED INVESTMENTS AND ASSOCIATED YEARLY BENEFITS AND COSTS

YEAR	ACTIVITY AND RESOURCE USE CONSIDERATIONS	NEW INVESTMENT COSTS	ESTIMATED YEARLY BENEFITS & COSTS WITH PROJECT BENEFITS	WITH PROJECT COSTS	WITHOUT PROJECT BENEFITS	WITHOUT PROJECT COSTS
1974	PROJECT CONST. FR+T	3543750				
1974	PROJECT CONST. TMBR	0				
	PROJECT MAINTENANCE			37926		39990
	VEHICLE OPER. (AVG)		519690		42198	
1978	TIMBER HARVEST $/YR		201000	120760	201000	121000
1983	TIMBER HARVEST $/YR		201000	120760	201000	121000
1988	TIMBER HARVEST $/YR		201000	120760	201000	121000
	REC.,EXISTING SITES		3075060	261926	3075060	261926
	SOIL & WATERSHED		0	8400		7800

PROJECT CONSTRUCTION AND R/W COSTS MAKE UP 100.0% OF THE TOTAL INVESTMENT OF $ 3543750 ON WHICH THIS ANALYSIS IS BASED

****

ESTIMATED RESOURCE USE -	WITH PROJ.	W/O PROJ.	WITH AS A % OF W/O
FACILITY LENGTH(MILES)	25.8	25.8	100.0%
TIMBER HARVEST VOLUME(MMBF)	20.0	20.0	100.0%
TIMBER HARVEST SEASON(MONTHS)	6.0	6.0	100.0%
AVERAGE ANNUAL RECREATION USE			
- TOTAL VISITOR DAYS/YEAR	580848	580848	100.0%
- % CAMPING	33.1%	33.1%	100.0%
- % PICNICKING	11.6%	11.6%	100.0%
- % HUNTING & FISHING	19.4%	19.4%	100.0%
- % OTHER REC. USE	22.2%	22.2%	100.0%
- % SPECIAL REC.USE	13.8%	13.8%	100.0%
AVERAGE ANNUAL ROAD USE			
- TOTAL VEHICLES/YEAR	208168	208168	100.0%
- % FOREST SERVICE	4.1%	4.1%	100.0%
- % TIMBER USE	.0%	.0%	100.0%
- % RECREATION USE	95.7%	95.7%	100.0%
- % OTHER USE	.1%	.1%	100.0%
ESTIMATED EROSION(CUBIC YDS/YR)	8400	7800	107.7%

****

EXHIBIT B) 16.43--6

~~Figure 2b RTECON OUTPUT~~ page 2 of 2

PROJECT RELATED ECONOMIC INDICATORS -

	DISCOUNT RATE	TOTAL DISCOUNTED BENEFITS	TOTAL DISCOUNTED COSTS	NET PRESENT WORTH	B/C RATIO
WITH PROJECT	6%	35547522	7487589	28059933	4.7
	10%	17620431	5410200	12210232	3.3
	15%	9826365	4288950	5537415	2.3
WITHOUT PROJECT	6%	31492941	4399604	27093336	7.2
	10%	15823384	2470812	13352572	6.4
	15%	8966173	1516939	7449234	5.9
WITH PROJ. AS A % OF W/O PROJECT	6%	112.9%	170.2%	103.6%	66.3%
	10%	111.4%	219.0%	91.4%	50.9%
	15%	109.6%	282.7%	74.3%	38.8%

INTERNAL RATE OF RETURN WITH PROJECT = 40.5%
INTERNAL RATE OF RETURN WITHOUT PROJECT IS GREATER THAN 100%
WITH PROJ. I.R.R. NOT CALCULATED AS A PERCENT OF W/O PROJ I.R.R.

****

MARGINAL BENEFIT COST ANAYLSIS -
(WITH PROJ. BENEFITS & COSTS MINUS WITHOUT PROJ. BENEFITS & COSTS)

DISCOUNT RATE	MARGINAL DISCOUNTED BENEFITS	MARGINAL DISCOUNTED COSTS	MARGINAL NET PRESENT WORTH	MARGINAL BENEFIT/COST RATIO
6%	4054581	3087985	966596	1.3
10%	1797048	2939388	-1142339	.6
15%	860192	2772010	-1911818	.3

****

i. General Economic Analyses. The following economic indicators should be analyzed:

(1) IRR With and Without Project.

(2) NPW (10%) With and Without Project.

(3) B/C (10%) With and Without Project.

(4) Marginal NPW (10%).

(5) Marginal B/C (10%).

j. Economic Value Benefits and Costs Checklist (with project and without project).

Timber Values:

Appraisal Values	Monthly Timber Appraisal Bulletins
Firewood	Market Value These Items
KV	
BD	
TSI	
Manufacturing Costs	
Logging Costs	

Recreation:

- Camping
- Picnicking
- Hunting and Fishing
- Sightseeing
- Backpacking
- Other

Fire:

- Facility Needs

Range:

- Facilities Needed
- Operations
- AUM Values

Fish and Wildlife:

- Administration
- Crossings (game and fish)

Soil and Water:

- Facilities Needed
- Flood Requirements
- Erosion Costs
- Water Values

Additional Environmental Costs:

- Funding to Support Environmental Needs
- Mitigation of Environmental Problems

Other:

- Investment Opportunities
- Miscellaneous
- Land Values

Transportation Facilities:

- Maintenance
- Operations
- Construction
- Reconstruction

2. Financial Impact Analysis: The financial analysis required is achieved by displaying the "cash flow" data required to do the economic analysis. Other financial analysis factors include initial investment and maintenance and operation costs with and without the project and who must pay; i.e., county, state, Forest Service, etc.

3. Environmental Impact Analysis: Environmental concerns must be analyzed in a subjective manner. Evaluation methodologies for Environmental Impact Analysis are similar to Social and Institutional Impact Analysis. Only the variables or elements considered are different. The three methods of comparative analysis documentation, scenario (see Exhibit 16.43--7); matrix (Delphi Method); or round table discussion, all are applicable. Exhibit 16.43--8 is a combination of all three methods which takes advantage of the good points of each. In this method, management establishes the priorities and the importance factor or multiplier for each rated element. Each element is rated for each alternative by the staff specialist concerned with that element. An interdisciplinary team should evaluate all ratings. The final ordinal ranking of alternatives is the sum of the subjective ratings. Environmental elements similar to those listed in Exhibit 16.43--8 should be analyzed.

4. Social Impact Analysis: The Forest Service has published a document, "Social Impact Assessment: An Overview", which should be used to guide the transportation planner in this effort. The following social criteria could be analyzed if relevant:

a. Community Culture Change

b. Recreational Opportunities

c. Special Group Access

d. Minority Group Impact

e. Historical and Archaelogical Sites

f. Land Allocation and Use

g. Population Stability

h. Population Density

i. Displacement of People

j. Population Distribution

k. Population Structure (sex and age)

l. Community Identity

m. Basic Value System

A rating summary of Social Impact Elements to help the rater understand what should be rated for each element is found in Exhibit 16.43--9.

5. Institutional Impact Analysis: The same method as used for Environmental and Social Impact Analysis can be used for the following institutional elements:

a. Political

b. Family

c. Religious

d. Military

e. Educational

f. Economic (employment and income)

g. Economic Infrastructure (Transportation and Communication)

A rating summary of institutional impact elements to help the rater understand what should be rated for each impact element is found in Exhibit 16.43--10.

EXHIBIT 7
~~TABLE 9~~

What about the "do-nothing" ~~alternative~~ ?

Comparison of Alternative Transportation System Plans

Changes From Existing Condition For Each Plan

	ALTERNATIVE PLANS			
	A	B	C	D
Miles of cinder surfaced road	12.5	8.6	7.6	2.6
Provides all-weather through road	Yes	No	No	No
Cost for system*	$240 M	$177 M	$177 M	$164 M
Ease to convert to all-weather through road	Accomplished	Moderate	Moderate	Difficult
Access for harvesting all products	Great improvement	Slight improvement	Slight improvement	Slight improvement
Wildlife disturbance	Great increase	Moderate increase	Slight increase	Very slight increase
Game law enforcement problems	Great increase	Moderate increase	Slight to moderate increase	Slight increase
Recreation use	Great increase	Slight to moderate increase	Slight increase	Slight increase
Mancaused fire risk	Moderate increase	Slight increase	Slight increase	Slight increase
Esthetics values	Very slight decrease	No change	No change	No change
Administrative access	Great improvement	Slight improvement	Slight improvement	Moderate improvement
Woods Canyon I&E opportunities	Great improvement	Slight improvement	Slight improvement	Moderate improvement

*Variable cost above terminal road system common to all plans. This terminal system is necessary for timber harvest and is estimated to cost $403,000 for 62 miles of terminal roads.

EXHIBIT 89 ~~84~~ 16, 43 - 7

ENVIRONMENTAL IMPACT EVALUATION OF CAPITAL INVESTMENTS

Project EH 12

DECISION FACTORS / ALT.	SOILS	WATER QUALITY	ATMOSPHERIC QUALITY	GEOLOGY	MINERALS	TIMBER	RANGE	RECREATION DEV.	RECREATION DISPERSED	ESTHETICS	WILDERNESS	FIRE HAZARD	FIRE RISK	NOISE	ENERGY	RARE AND UNIQUE SPECIES	WILDLIFE	WATERLIFE	NON ADJUSTED RATING	
PRIORITY	H	H	M	H	H	M	M	M	M	M/H	L	M	L	M	M	M	H	M	L	
MULTIPLIER	4	4	2	4	4	2	2	2	2	3.0	1	2	1	2	2	2	4	2	1	46.0
1 Do Nothing	-7	-5	0	+4	0	+8	-5	+3	+7	+5	0	-9	-9	+7	+1	0	-7	-5	0	-12	Rating
	-28	-20	0	+16	0	+16	10	+6	+14	+15	0	-18	-9	+14	+2	0	-28	-10	0		-41
2	0	-2	+3	0	-3	+4	-1	+6	+5	+5	-2	0	-2	+8	-1	-2	-1	-5	0	+12	Rating
	0	-8	+6	0	+12	+8	-2	+12	+10	+15	-2	0	-2	+16	-2	-4	-4	-10	0		+21
3	-7	-9	+1	+5	+1	+6	-8	+6	+ 7	+4	-2	-5	-5	+5	-1	-3	-9	- 5	0	-21	Rating
	-28	-36	+2	+20	+4	+12	-16	+12	+14	+12	-2	-10	-5	+10	-2	-6	-36	-10	0		-73
4	0	-2	0	+5	0	+8	-5	+3	+8	+8	+1	-5	-5	+7	+2	0	-2	-1	0	+22	Rating
	0	-8	0	+20	0	+16	-10	+6	+16	+24	+1	-10	-5	+14	+4	0	-8	-2	0		+58

Exhibit 16.43-9

RATING OF SOCIAL IMPACT VARIABLE FOR
FEASIBILITY ANALYSIS FOR PLANNING AND PROGRAMING

Decision Factor: What you really want to know is whether and how the proposed action or alternative will: . . . in the zone of influence.

COMMUNITY CULTURE CHANGE	- change population characteristics
	- impact the community character
	- enhance or deter from community facilities and services
	- impact community organizations and activities
	- change the "sense" or "feeling" of security or insecurity for the people
RECREATIONAL OPPORTUNITIES	- change the capacity of the land for carrying, sustaining, or supporting a range of recreational activities
	- change the supply or availability of recreation opportunities
	- change recreation demand levels for both Forest and non-Forest recreation
	- change the likelihood or degree to which a defined optimal recreationist is likely to experience fulfillment
SPECIAL GROUP ACCESS (Elderly, Poor, Transit Dependent)	- change availability of programs for special groups
	- increase or decrease the differential special group access
OPEN SPACE	- change open space availability
MINORITY GROUP IMPACT AND CIVIL RIGHTS	- differentially impact minority populations
	- differentially impact minority populations in a way which is consistent with social policies or programs
	- change the ability of groups to exercise their civil rights

	- increase or decrease the extent to which physical barriers impact community cohesion
	- change social class composition and if such changes will impact community cohesion
	- impact the attitude basis of community cohesion
	- change special community activities
LAND ALLOCATION AND USE	- change land uses on a variety of adjacent and non adjacent lands (the range of "Whose land?" and "Where is the land?")
	- generate changes in land use which are likely to exceed carrying capacity of adjacent lands and/or actually change the environmental carrying capacity of these lands
	- change how people relate to the landscape
LAND USE REGULATION	- change the number and type of conditional use and building permits on adjacent private lands
	- impact from a compatibility standpoint existing comprehensive plans and zoning regulations (NF and adjacent lands)
POPULATION STABILITY	- change perspectives (attitudes, opinions, beliefs) about population growth, stability, or decline
	- change the size of the population
	- change or alter existing population projections
POPULATION DENSITY	- impact the population density and crowding
DISPLACEMENT OF PEOPLE	- result in forced displacement or eviction of people from lands which they currently occupy (work, live, shop, or play)
	- change land use patterns to the extent that displacement will occur
POPULATION DISTRIBUTION AND MOBILITY	- change population distribution
	- result in geographic mobility for those already living or working and those likely to come from outside

	- change the rate of intra or intergenerational mobility
POPULATION (Age and Sex)	- change the age and/or sex composition of the population
COMMUNITY IDENTITY	- change the extent to which "community context" is an important consideration (create new communities, depopulate, impact the extent to which "community context" is an important social category (we-they distinctions, community or subcommunity, conflicts occur along community lines)
	- change the symbolic meanings held by individuals
BASIC VALUES	- change basic value orientations
	- impact basic value dimensions
	- change basic value rankings

Exhibit 16.43 - 70

RATING INSTITUTIONAL IMPACT VARIABLES FOR
FEASIBILITY ANALYSES FOR PLANNING AND PROGRAMING

Variable: What you really want to rate is whether and how the Proposed Action or Alternatives will: . . . within the zone of influence.

POLITICAL	- increase or decrease governmental size and density
	- change the distribution of people in terms of political party preference
	- impact revenues available to city, county, other local governmental units, and politically influenced organizations
	- increase or decrease the number and type of citizen-government linkages and the citizen satisfaction with government
	- cause changes in the voluntary associations
FAMILY	- change the characteristics of families
	- change the distribution of certain family characteristics of the population
	- impact those economic factors which, in turn, have a high probability of impacting family characteristics and stability
	- change the use of Forest lands for family "use" and "participation"
RELIGIOUS	- impact those basic values and norms which are closely linked or especially emphasized by the religious institution
	- change religious system resources measured by either the amount of resources available or the level of resource utilization
MILITARY	- impact the military through a change in military consumption of Forest products - flow of Forest commodities

EDUCATIONAL	- change the level and source of money for the educational system (source and expenditure of funds)
	- change the content or emphasis of educational programs (expansion or contraction of programs)
	- change the number and type of educational personnel (administrators, teachers, support personnel)
	- change use levels of existing facilities and equipment or result in need for new facilities and equipment
	- change the size of school enrollments and the number of employers with specific educational requirements
	- change the educational characteristics of the population (distribution of population in terms of years of school completed)
	- increase or decrease the range of educational and scientific opportunities within the Forest
	- change access of students and scientists within the zone of influence to Forest educational and scientific resources
ECONOMIC (EMPLOYMENT & INCOME)	- change the economic level of those living in rural areas (employment and income impacts felt by rural)
	- impact on services and prices of commodities
ECONOMIC (INFRASTRUCTURE)	- impact the Forest and community transportation system
	- result in a change in existing legal access limits (rules, regulations)
Transportation	- mobility patterns of Forest users as expressed in travel time between different areas
	- change seasonality of access to different areas of the Forest
	- generate a change in the number or range of transportation equipment (timber harvest, minerals, public, and recreational)

	- change the amount of transportation facilities
	- change the distribution of transportation facilities and places along the travel-through vs. destination dimension and change the dominant use at important places
	- change travel difficulty and change the distribution of total facilities in terms of difficulty class
Communications Media	- change communications opportunities
	- result in changes in the media linkages of the population (population size and structure)
	- change the emphasis or content of those media available (coverage of local through national issues)
	- increase or decrease the amount of advertising, primarily in the local media
Utilities	- influence the availability of supply of Forest resources used by utilities
	- affect utilities' use of the Forest for transportation purposes (ROW, maintenance access, etc.) and the actual construction of utilities which process Forest resources
	- change per capita and total consumption levels for the range of utilities (demand and supply)
	- cause utilities or special districts to cross major capability "thresholds"
	- change the role or contribution of special districts as voluntary associations or social support systems
Housing	- impact housing supply, quality, related economic factors, and Forest related housing materials
Emergency Preparedness and Law Enforcement and Safety	- impact changes in likelihood of occurrence of natural disasters
	- impact the existing emergency infrastructure
	- alter normative judgments of behavior by changes in definitions of "what is legal" or the degree of enforcement of that which is illegal

	- change rate or type of illegal behavior
	- influence the type of personnel and facilities which form the law enforcement and justice system
	- change the "amount" of output of the law enforcement and justice system
	- increase or decrease accident rates for those using and administering the Forest lands
Health	- change the rate of physical or mental disease in the population
	- change the availability (number and distribution) of health facilities and equipment
	- change the availability of health system personnel
	- impact the returns to the counties by governmental support of the local health system
Social Services and Public Assistance	- influence the availability, costs, scope, and quality of health services
	- change the availability of social welfare services by different "supply" factors
	- increase or decrease the number and type of persons receiving welfare or some other type of public assistance or services
	- affect the level of Forest Service receipts to the county

16.44 - Alternative Evaluations. All of the impacts, market valued, quantifiable, or illquantifiable (social, environmental, institutional, economic, and financial) must be evaluated for each alternative action. Differences between all alternatives for each variable must be evaluated. Display techniques are available to show tradeoff evaluations among alternatives (see Exhibit 16.43--7). The decision factors for each impact should be prioritized by management and each decision factor rated for each alternative plan by the staff person with the required expertise.

Some uniformity is necessary to equivalently rate the five impact areas. It is best to adjust all impact element ratings to a -9 to +9 scale. Management should also prioritize on a uniform and consistent basis. Low, medium, and high priorities having importance factors (multipliers) of 1 to 4, are recommended.

1. Economic Impact Evaluation: The five economic indicators listed under 16.43--i must be evaluated for each alternative. The following indicator rating criteria is recommended: (Exhibit 16.55--1).

EXHIBIT 16.44--1
ECONOMIC IMPACT EVALUATION RATING CRITERIA

Indicator Rating	IRR	NPW10%	B/C10%	Marginal NPW	Marginal B/C
-3	< 3%	<-500,000	< .4	<-100,000	< .4
-2	3 to 6%	-100,000 to - 500,000	.4 to .6	-100,000 to -10,000	.4 to .6
-1	6 to 9.5%	-10,000 to - 100,000	.6 to .9	-10,000 to 0	.6 to .9
0	9.5 to 10.5%	-10,000 to +25,000	.9 to 1.1	0 to 10,000	.9 to 1.1
+1	10.5 - 15%	+25,000 to +250,000	1.1 to 1.6	10,000 to 100,000	1.1 to 1.6
+2	15 - 25%	+150,000 to 2,000,000	1.6 to 2.5	100,000 to 1,000,000	1.6 to 2.5
+3	> 25%	> +2,000,000	> 2.5	>1,000,000	> 2.5

With the five economic indicators rated from -3 to +3 as shown in Exhibit 16.44--1, it is necessary to normalize the economic evaluation by multiplying by a factor of 9/15 to be consistent with the -9 to +9 rating scale. Without this normalization, Economic Impacts would have a potential rating of -15 to +15. The factor of 9/15 reduces the potential rating to -9 to +9. See pp. 47 for completed example.

2. Financial Impact Evaluation: The three financial indicators (annualized cash flow, reduced annualized operation and maintenance, and initial investment) should be rated to evaluate the financial impacts of the alternative actions. The following table (Exhibit 16.44--2) lists a recommended rating system for the financial impacts to achieve an overall -9 to +9 financial rating range:

EXHIBIT 16.44--2
FINANCIAL IMPACT EVALUATION RATING CRITERIA

Indicator Rating	Who Pays	Reduced O&M (Annualized With-Without)	Initial Investment $
-3	Special Group Oriented Single Function	> +$2,500	> 1,000,000
-2	Forest Funded-Limited Access to One or Two Functional Uses	+$500 to +$2,500	250,000 to 1,000,000
-1	Forest Funded Public Use Road	0 to +$500	100,000 to 250,000
0	Timber Purchaser User Pays	-100 to +100	25,000 to 100,000
+1	Maximum Economy Timber Purchaser User Pays	0 to -$500	5,000 to 25,000
+2	Cooperative Agreement User Pays	-$500 to -$2,500	500 to 5,000
+3	Forest Highway Funded or User Public Oriented or Multiple Use	<-$2,500	0 to 500

Project_____

ECONOMIC IMPACT EVALUATION

Decision Factors / Alternative	IRR	NPW(10%) $	B/C(10%)	Marginal NPW(10%) $	Marginal B/C(10%)	Total	Normalized Total Rating [Total X 9/15]

FINANCIAL IMPACT EVALUATION

Decision Factors / Alternatives	Who Pays	Reduced Annualized O&M Rating	Initial Investment Rating	Total Rating

Exhibit 16.44--3 illustrates the Economic and Financial Impact Evaluation formats.

3., 4., and 5. Social, Environmental, and Institutional Impact Evaluations: Social, environmental, and institutional indicators can be evaluated on a scale of -9 to +9 with the corresponding adjectives in Exhibit 16.44--4:

EXHIBIT 16.44--4

MODIFYING ADJECTIVES

+9	Superior advantages
+8	
+7	Major improvement
+6	
+5	Significant positive effect
+4	
+3	Minor positive effect
+2	
+1	Minimal positive effect
0	No net effect
-1	Minimal negative effects

-2

-3 Minor negative effect

-4

-5 Significant net adverse effect

-6

-7 Major adverse effect

-8

-9 Extreme adverse effect

All indicators (decision factors) can be prioritized, low to high, to meet management goals. Importance factors (multipliers) must be applied by management. Exhibit 16.44--5 shows a recommended priority and importance factor rating system.

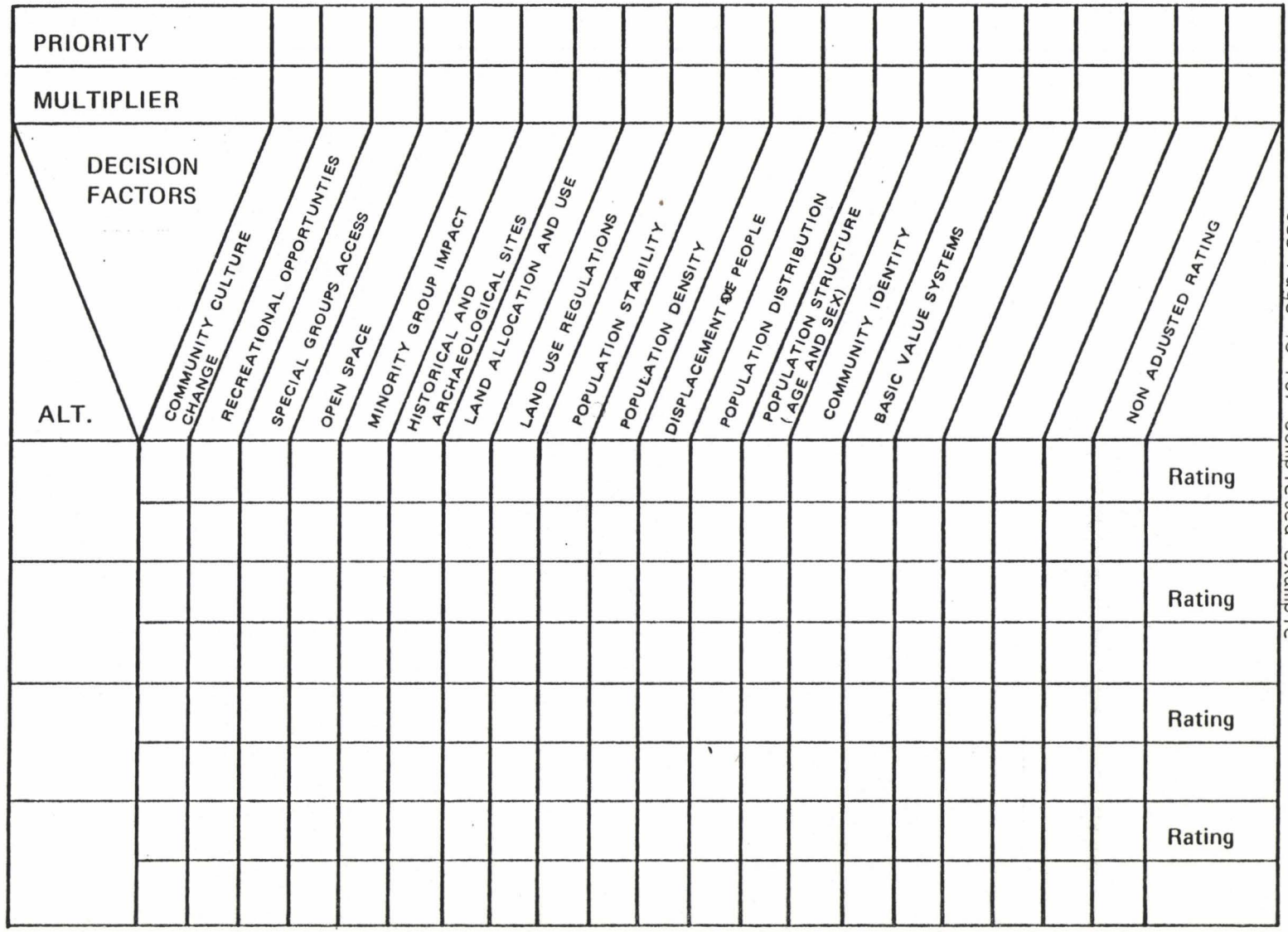
EXHIBIT 16.44--5

PRIORITY RATINGS AND IMPORTANCE FACTORS

Priority	Importance Factor (multiplier)
H - High	4.0
MH - Medium High	3.0
M - Medium	2.0
ML - Medium Low	1.5
L - Low	1.0

SOCIAL IMPACT EVALUATION OF CAPITAL INVESTMENTS

Project _____



See Page 48 for completed example

ENVIRONMENTAL IMPACT EVALUATION OF CAPITAL INVESTMENTS

Project _____

PRIORITY																						
MULTIPLIER																						
DECISION FACTORS / ALT.	SOILS	WATER QUALITY	ATMOSPHERIC QUALITY	GEOLOGY	MINERALS	TIMBER	RANGE	RECREATION DEV.	RECREATION DISPERSED	ESTHETICS	WILDERNESS	FIRE HAZARD	FIRE RISK	NOISE	ENERGY	RARE AND UNIQUE SPECIES	WILDLIFE	WATERLIFE	NON ADJUSTED RATING	
																				Rating
																				Rating
																				Rating
																				Rating

See page 49 for completed example

INSTITUTIONAL IMPACT EVALUATION OF CAPITAL INVESTMENTS

Project _____

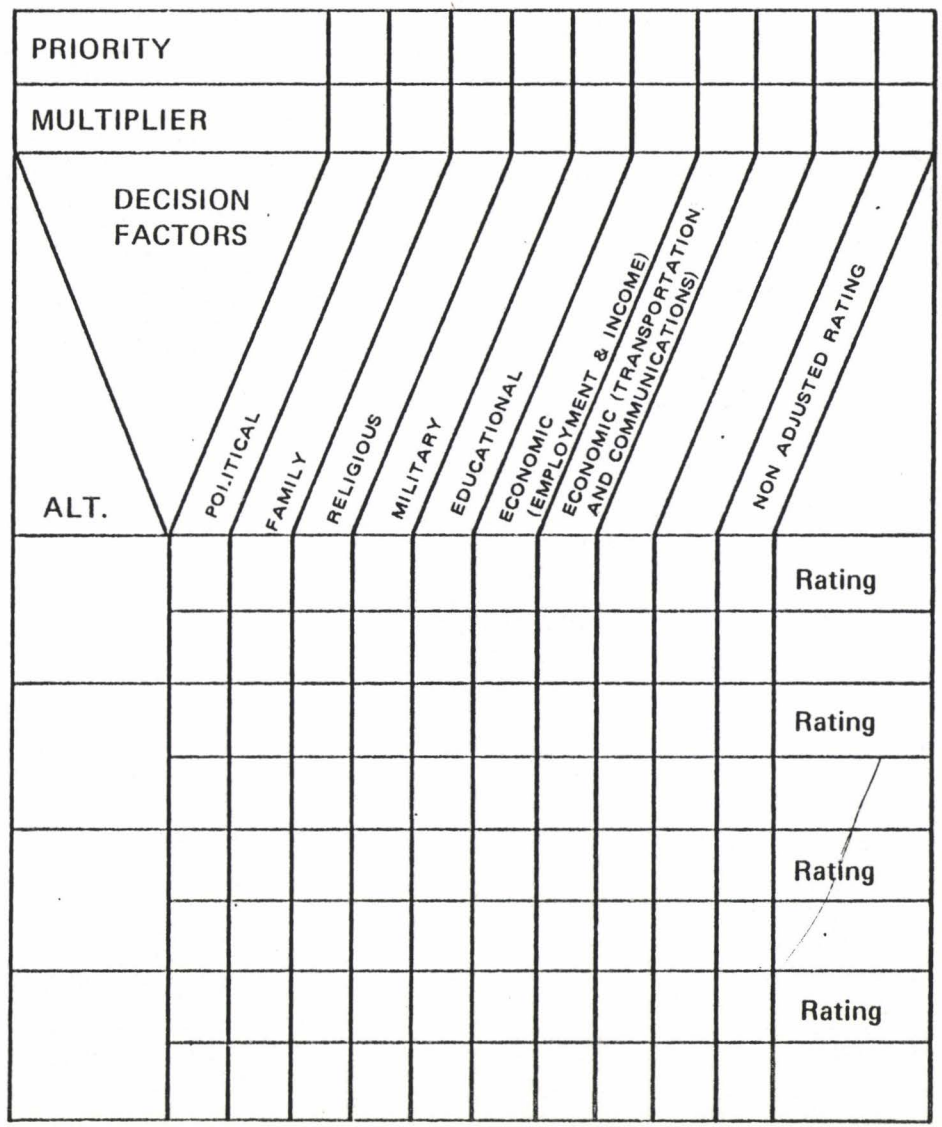


EXHIBIT 16.44-8

See page 50 for completed example

TOTAL IMPACT DECISION
MATRIX
PROJECT_____

Total Impact Evaluation

Priority						Σ
Multiplier						
ΣMultipliers						
ALT.	Institution	Social	Environmental	Financial	Economic	Non-adjusted Rating	Rating
1/							
2/							
3/							

1/ Impact rating from Impact Evaluation Pages.
2/ Normalized impact rating for each Impact Evaluation or 1/ ÷ Σmultipliers.
3/ Weighted rating = multiplier times normalized rating.

The priorities on this Total Impact Evaluation must be mutually exclusive - one high, one medium high, one medium, one medium low, and one low to achieve a summation of multipliers equal to 11.5 (1.0 + 1.5 + 2.0 + 3.0 + 4.0 = 11.5).

To achieve uniform rating for all five impact evaluation, each having a -9 to +9 potential rating, the final evaluation number for social, environmental, and institutional evaluations for each alternative must be normalized by dividing the raw total by the sum of the priority multipliers. In the example problem that follows, Alternative 4's Environmental Impact Evaluation, rating is +58; when normalized, the rating divided by the sum of the multipliers (46.0) is +58/46.8 = +1.26. Exhibits 16.44--6, 7, and 8 illustrate the format for social, environmental, and institutional impact evaluations.

6. Total Impact Evaluation: Each impact is rated -9 to +9 (normalized) in the above evaluations. All evaluations can now be combined for a total impact evaluation. Management must now rank the relative importance of each of the impact areas using the same low to high priorities with accompanying importance factors (multipliers). This prioritizing should be mutually exclusive - only one low, one medium/low, one medium, one medium/high, and one high priority ranking for the five impact evaluation ratings (which now are decision factors). The multipliers here will always sum up to 11.5 (1.0 + 1.5 + 2.0 + 3.0 + 4.0 = 11.5). See Exhibit 16.44--9.

Three rows are available under each alternative action (or project). The first row is for the unadjusted rating (from each impact evaluation sheet), the second row is the normalized rating (the unadjusted rating divided by the sum of the impact multipliers), and the third is the weighted normalized rating. Note that the weighted normalized rating

ranges from a maximum of +36 (with +9 rating and a 4.0 multiplier) to -36 (with -9 rating and a 4.0 multiplier). The total rating could, then, vary from a maximum of +103.5 to a minimum of -103.5. The manager can have more flexibility on ranking the five impacts in the composite rating evaluation. An easy way would be to simply normalize by dividing by the sum of the multipliers, 11.5, to achieve a composite -9 to +9 rating.

16.45 - Example Alternative Analyses and Alternative Evaluation. An example is included here to show how the evaluation of four alternatives for an arterial road can be done.

The highway which is analyzed and evaluated below represents a large capital investment with large annual cash flows. It should be noted that each element of the social, institutional, and environmental evaluations should be analyzed by the specialist directly associated with that element. Separate documents justifying the numerical rating must accompany each evaluation.

ECONOMIC ANALYSES - PROJECT FH-12

Economic Indicators				Marginal Economics	
		$NPW_{10\%}$		$NPW_{10\%}$	$B/C_{10\%}$
Alternative	IRR	$	$B/C_{10\%}$	$	
Without					
1	1%	-$385,680	.94	0	1.00
2	6.1%	-$9,000	1.01	+376,970	1.13
3	5.1%	-$70,000	.9	+315,760	1.10
4	4.1%	-$120,000	.81	+265.390	1.06

FH-12 FINANCIAL ANALYSES

Cash Flow in $1,000

Alternative	1 Without		2		3		4	
	Costs M	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits
Initial Cost	0		6,000		6,200		8,000	
Operations and Maintenance Annually for 20 Years	750	704.7	390	1093.7	395	1115.0	350	1275.5
Year 20								

Project FH-12

ECONOMIC IMPACT EVALUATION

Decision Factors / Alternative	IRR	NPV(10%) $	B/C(10%)	Marginal NPW(10%) $	Marginal B/C(10%)	Total	Normalized Total Rating [Total X 9/15]
1 Do Nothing	-3	-2	0	0	0	-5	-3.0
2	-1	0	0	+2	+1	+2	+1.2
3	-2	-1	0	+2	+1	0	0
4	-2	-2	-1	+2	0	-3	-1.8

* See Page 35 for explanation of 9/15 factor to Normalize Rating

FINANCIAL IMPACT EVALUATION

Decision Factors / Alternatives	Who Pays	Reduced Annualized O&M Rating	Initial Investment Rating	Total Rating
1 Do Nothing	-3	0	+3	0
2	+3	+3	-3	+3
3	+3	+3	-3	+3
4	+3	+3	-3	+3

SOCIAL IMPACT EVALUATION OF CAPITAL INVESTMENTS

Project FH 12

PRIORITY		M	H	H	M	L	L	H	M	L	L	M	L	L	M	L					
MULTIPLIER		2	4	4	2	1	1	4	2	1	1	2	1	1	2	1					29
DECISION FACTORS / ALT.	COMMUNITY CULTURE CHANGE	RECREATIONAL OPPORTUNITIES	SPECIAL GROUPS ACCESS	OPEN SPACE	MINORITY GROUP IMPACT	HISTORICAL AND ARCHAEOLOGICAL SITES	LAND ALLOCATION AND USE	LAND USE REGULATIONS	POPULATION STABILITY	POPULATION DENSITY	DISPLACEMENT OF PEOPLE	POPULATION DISTRIBUTION	POPULATION STRUCTURE (AGE AND SEX)	COMMUNITY IDENTITY	BASIC VALUE SYSTEMS				NON ADJUSTED RATING	
1	0	+2	+4	0	0	0	0	0	0	0	-1	0	0	0	+1					+6	Rating
Do Nothing	0	+8	+16	0	0	0	0	0	0	0	-2	0	0	0	+1						+23
2	-3	+2	+3	-3	-1	0	-1	0	-1	0	-4	0	0	-1	-1					-8	Rating
	-6	+8	+12	-6	-1	0	-4	0	-1	0	-8	0	0	-2	-1						-9
3	-2	+2	+3	-3	-1	0	+2	0	-1	0	-3	0	0	-1	-1					-5	Rating
	-4	+8	+12	-6	-1	0	+8	0	-1	0	-6	0	0	-2	-1						+7
4	0	+4	-1	+2	0	0	+4	0	0	0	0	0	0	0	0					+9	Rating
	0	+16	-4	+4	0	0	+16	0	0	0	0	0	0	0	0						+32

ENVIRONMENTAL IMPACT EVALUATION OF CAPITAL INVESTMENTS

Project EH 12

PRIORITY	H	H	M	H	H	M	M	M	M	M/H	L	M	L	M	M	M	H	M	L	
MULTIPLIER	4	4	2	4	4	2	2	2	2	3	1	2	1	2	2	2	4	2	1	
DECISION FACTORS / ALT.	SOILS	WATER QUALITY	ATMOSPHERIC QUALITY	GEOLOGY	MINERALS	TIMBER	RANGE	RECREATION DEV.	RECREATION DISPERSED	ESTHETICS	WILDERNESS	FIRE HAZARD	FIRE RISK	NOISE	ENERGY	RARE AND UNIQUE SPECIES	WILDLIFE	WATERLIFE	NON ADJUSTED RATING	
1 Do Nothing	-7	-5	0	+4	0	+8	-5	+3	+7	+5	0	-9	-9	+7	+1	0	-7	-5	0	-12	Rating
	-28	-20	0	+16	0	+16	10	+6	+14	+15	0	-18	-9	+14	+2	0	-28	-10	0		-41
2	0	-2	+3	0	-3	+4	-1	+6	+5	+5	-2	0	-2	+8	-1	-2	-1	-5	0	+12	Rating
	0	-8	+6	0	+12	+8	-2	+12	+10	+15	-2	0	-2	+16	-2	-4	-4	-10	0		+21
3	-7	-9	+1	+5	+1	+6	-8	+6	+ 7	+4	-2	-5	-5	+5	-1	-3	-9	- 5	0	-21	Rating
	-28	-36	+2	+20	-4	+12	-16	+12	+14	+12	-2	-10	-5	+10	-2	-6	-36	-10	0		-73
4	0	-2	0	+5	0	+8	-5	+3	+8	+8	+1	-5	-5	+7	+2	0	-2	-1	0	+22	Rating
	0	-8	0	+20	0	+16	-10	+6	+16	+24	+1	-10	-5	+14	+4	0	-8	-2	0		+58

46.0

INSTITUTIONAL IMPACT EVALUATION OF CAPITAL INVESTMENTS

Project FH 12

PRIORITY		H	L	L	L	L	M	H			
MULTIPLIER		4	1	1	1	1	2	4			14
ALT. \ DECISION FACTORS		POLITICAL	FAMILY	RELIGIOUS	MILITARY	EDUCATIONAL	ECONOMIC (EMPLOYMENT & INCOME)	ECONOMIC (TRANSPORTATION AND COMMUNICATIONS)			NON ADJUSTED RATING
1 Do Nothing		+7	+1	0	0	+2	+1	+6			+17	Rating
		+28	+1	0	0	+2	+2	+24				+57
2		+5	+2	0	0	+1	+1	+1			+10	Rating
		+120	+2	0	0	+1	+2	+4				+29
3		+4	+2	0	0	+1	+2				+10	Rating
		+16	+2	0	0	+1	+4	+4				+27
4		0	+1	0	0	+1	+3	+6			+11	Rating
		0	+1	0	0	+1	+6	+24				+32

TOTAL IMPACT DECISION
MATRIX
PROJECT FH-12

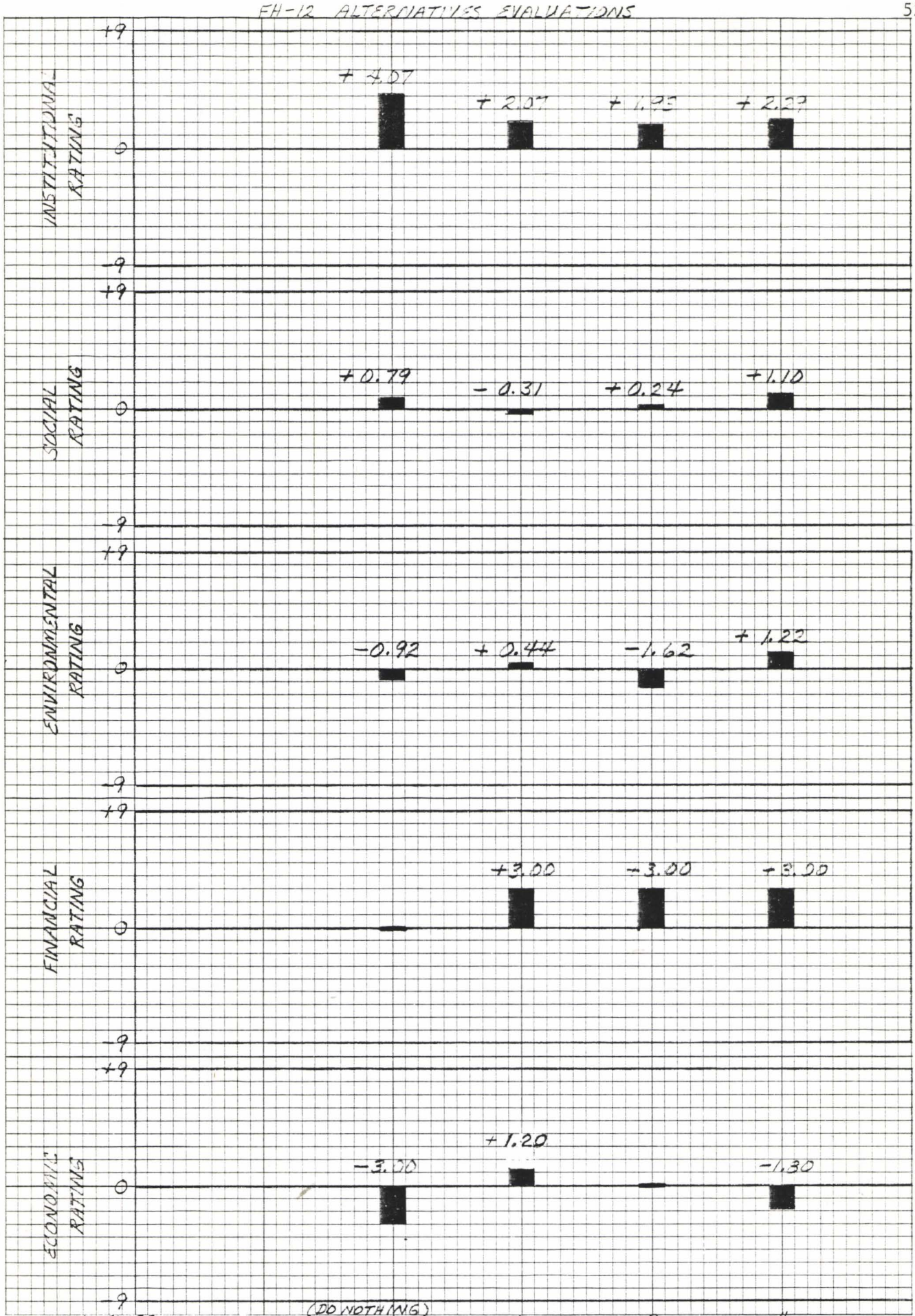
Total Impact Evaluation

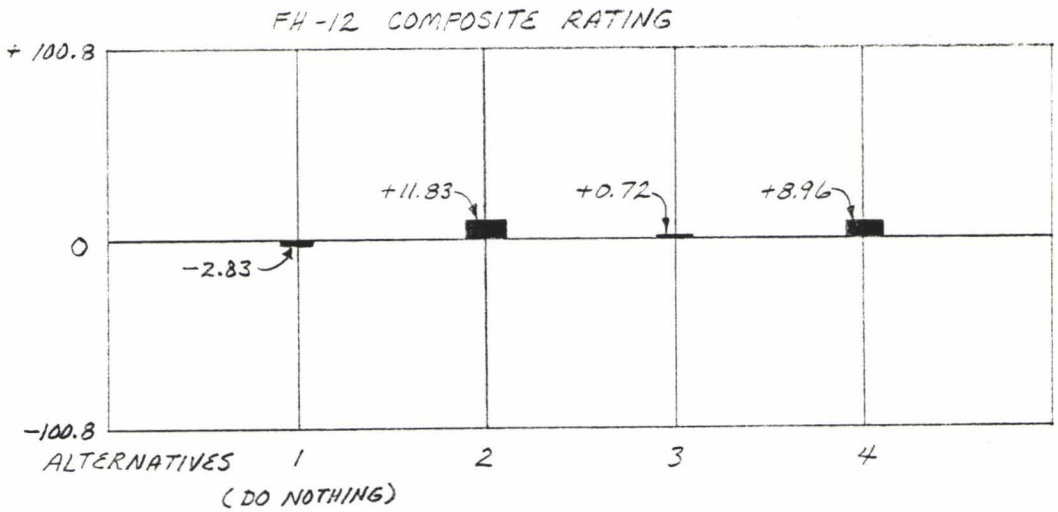
Priority		M	M/L	H	L	M/H	Σ
Multiplier		2	1.5	4	1	3	11.5
Σ Multipliers		14	29	46	1	15/9	
ALT.		Institution	Social	Environmental	Financial	Economic	Non-adjusted Rating / Rating
1 Do Nothing	1/	+57	+23	-41	0	-5	
	2/	+ 4.07	+ 0.79	- 0.89	0	-3	+0.97
	3/	+ 8.14	+ 1.19	- 3.57	0	-9	- 3.24
2		+29	- 9	+21	+3	+2	
		+ 2.07	- 0.31	+ 0.46	+3	+1.2	+6.42
		+ 4,14	- 0.47	+ 1.83	+3	+3.6	+12.1
3		+27	+ 7	-73	+3	0	
		+ 1.93	+ 0.24	- 1.59	+3	0	+3,58
		3.86	+ 0.36	- 6.35	+3	0	+ 0.87
4		+32	+32	+58	+3	-3	
		+ 2,29	+ 1,10	+ 1,26	+3	-1.8	+5,85
		+ 4,58	+ 1,66	+ 5,04	+3	-5,4	+ 8,88

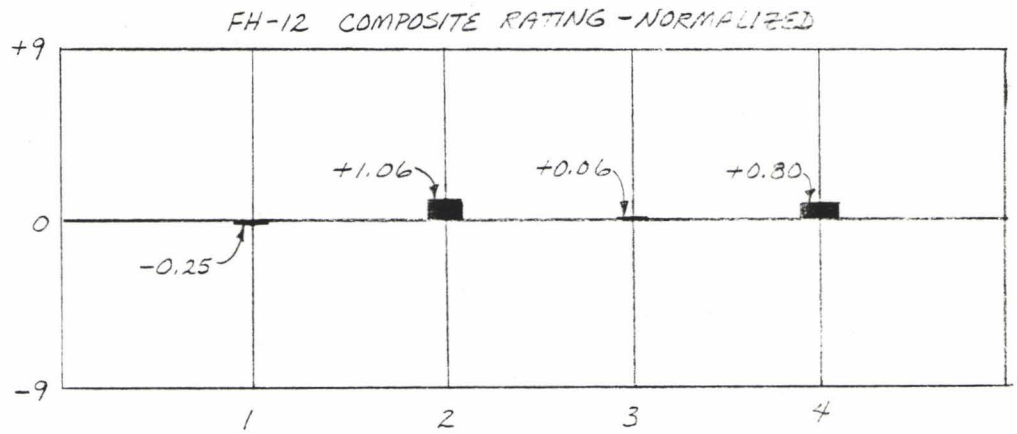
1/ Impact rating from Impact Evaluation Pages.
2/ Normalized impact rating for each Impact Evaluation or 1/ ÷ Σ multipliers.
3/ Weighted rating = multiplier times normalized rating.

The priorities on this Total Impact Evaluation must be mutually exclusive - one high, one medium high, one medium, one medium low, and one low to achieve a summation of multipliers equal to 11.5 (1.0 + 1.5 + 2.0 + 3.0 + 4.0 = 11.5).

FH-12 ALTERNATIVES EVALUATIONS




FH-12 COMPOSITE RATING
+100.8
0
-100.8
+11.83
+0.72
+8.96
-2.83
ALTERNATIVES
1
2
3
4
(DO NOTHING)


FH-12 COMPOSITE RATING - NORMALIZED
+9
0
-9
+1.06
+0.06
+0.80
-0.25
1
2
3
4

16.46 - Decisionmaking. Management is given the authority to make decisions with respect to capital investments. The analysis-evaluation process which preceded this section discusses rational decision logic. Many times management must make decisions which contradict this rational decision logic due to the overwhelming impact of one or more of the decision factors. For example, the presence of an endangered species on one alternative road route may justify a different management decision than the rational choice resulting from the evaluation process which has been presented here. This decision must be documented with the foregone benefits enumerated. These foregone benefits are the costs of choosing a less attractive alternative.